

testaceous, the posterior part deep red shaded with black; the whole body smooth and glabrous.

*Habitat.* Cape of Good Hope (*Peringuey*). 1 ♂, 4 ♀, one larva in my collection.

In size and in appearance most nearly resembles *Ch. Bolivari*, Dubr.; it is distinguished, among other things, by the form of the pygidium of the ♂. It is the first species of the genus discovered in Africa. The specimens are labelled under this name by de Bormans, but I can find no reference to it in any of his notes or letters except a drawing in the "album."

The single male is carded, so it is impossible to examine the ventral surface.

Dormans Park, East Grinstead,  
December 1902.

#### XXXIV.—A Revision of the Fishes of the Family Lophiidae. By C. TATE REGAN, B.A.

THE Lophiidae, as here understood, are equivalent to the genus *Lophius*, Linn., as restricted by Cuvier and accepted by Günther, and may be defined as Pediculates\* with large depressed head, wide mouth, three gills, pseudobranchiæ, pectorals each supported by a pair of basal bones, and ventrals with one spine and five soft rays. In the present paper twelve or thirteen species are recognized as probably distinct, of which eight are represented in the British Museum collection, including three which are described below as new to science. These species are grouped into three genera—*Chirolophius*, gen. nov., *Lophiomus*, Gill, and *Lophius*, Linn.,—the first being characterized by the position of the gill-

\* The definition of the Pediculati given by Messrs. Jordan and Sindo (Proc. U.S. Nat. Mus. xxiv. 1902, p. 361) is applicable to the Lophiidae with the exception of the phrase "Upper pharyngeals 2, similar, spatulate, with anterior stem and transverse blade." *Lophius piscatorius* has four branchial arches, the fourth without a gill, the first three bearing gills in their lower halves only. The first three epibranchials are united, but the limits of each can be distinguished; the first is about  $\frac{2}{3}$  as long as the second, to the basal part of which it is joined, and its upper pharyngeal is wanting; the second and third separate superiorly, and each bears an upper pharyngeal, as does the fourth epibranchial, which is strong, and at its upper end united to the third. The three upper pharyngeals on each side are coalescent; the last bears hardly any teeth, but is as well developed as the two preceding it, which are strongly toothed. The "anterior stems" are obviously the epibranchials, the first three uniting to form one "stem," the fourth being the other.

openings, which in part lie in front of and above the pectorals, differing in this respect from *Lophiomus* and *Lophius*, in which the gill-openings are entirely below and behind the pectorals. *Chirolophius* and *Lophiomus* agree in having about nineteen vertebræ, the teeth in the lower jaw in three or four series, and also the last ray of the dorsal and anal cleft to the base, but borne by a single basal bone, whereas *Lophius* has the vertebræ in increased number, about two series of teeth in the lower jaw, and the last ray of dorsal and anal simple. The gill-openings in *Chirolophius* resemble those of more normal fishes with regard to their position, and the nature of the last dorsal and anal rays also seems to indicate that in this family the most specialized forms are those with the vertebræ in increased number.

There are many features which are common to all the fishes of the family which it is superfluous to repeat in specific descriptions: the ridges and spines borne by the bones of the head, more prominent in young examples than in adults, are constant in position, as are the rays of the spinous dorsal, of which the first two are supported by a single movable basal bone which lies between the posterior processes of the premaxillaries, the third is situated on the head behind the level of the eyes, and the other rays, one to three in number, form a more or less continuous fin behind the head. The lower jaw has always an outer series of fixed teeth, wanting anteriorly, increasing in size posteriorly, and internal to these a number of pointed, hinged, depressible teeth, anteriorly in two to five series, posteriorly in one or two, the inner teeth being the longest. The premaxillaries have posteriorly a single series of small fixed teeth, and anteriorly a double series of depressible teeth, those of the inner series being the longest. The palatines have each a few teeth in a single series, the anterior of which are enlarged. The sub-spherical nasal sacs are very similar to those of some Tetrodontæ, in all cases the anterior nostril is on the front side, the posterior on the top of the sac. The projecting lower jaw causes the exposure of the anterior part of the floor of the buccal cavity; on this account the velum of the lower jaw and the anterior part of the tongue, except the margin, which is concealed beneath the velum, have a similar colour to the upper surface of the body.

The characters which seem of most use in determining species are the number of rays in the dorsal, anal, and pectoral fins, the length of the rays of the spinous dorsal (the first ray seems to become relatively longer during growth, but if, as frequently happens, it is broken off, a fresh flap

develops at its end; the posterior rays become more and more concealed with increase in size), the length and shape of the humeral spine, the size and number of the teeth, and the size of the eye, but all these features are subject to considerable variation.

*Synopsis of the Genera.*

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|---|--------------------------------|
| I. Gill-openings partly below, partly in front of and above the pectorals. Teeth in the lower jaw mostly in 3 or 4 series; about 19 vertebræ..... | 1. <i>Chirolophius</i> , g. n. |
| II. Gill-openings entirely below or behind the pectorals.   |                                |
| A. Teeth in the lower jaw mostly in 3 series; about 19 vertebræ .....   | 2. <i>Lophiomus</i> , Gill.    |
| B. Teeth in the lower jaw mostly in 2 series; 27-32 vertebræ .....  | 3. <i>Lophius</i> , Linn.      |

CHIROLOPHIUS, gen. nov.

Teeth in the lower jaw mostly in 3 series, anteriorly in 4 or 5 series; opercular membrane with a free posterior margin; gill-openings extending on to the upper surface in front of the pectorals; pectorals with 13-18 rays, posterior to the gill-openings. Dorsal with IV-VI, 7-9 rays, anal with 5-6, the last ray of each cleft to the base and supported by a single basal bone. Vertebræ about 19.

The three species of this genus which are represented in the British Museum are described below under the names *Ch. Naresii*, Günther, *Ch. Moseleyi*, sp. n., and *Ch. Murrayi*, sp. n. The following also appear to belong to this genus:—*Lophius gracilimanus*, *mutilus*, and *lugubris*, Alcock, and *Lophiomus spilurus*, Garman.

Three specimens taken by the 'Challenger' were described by Dr. Günther under the name *Lophius Naresii*, after Sir George Nares. They appear to me each to belong to distinct but closely allied species, and the largest example, from the Philippines, figured in the "Challenger" Shore-Fishes," pl. xxv., must be regarded as the type of *Ch. Naresii*. This figure is excellent, except for the fact that the last dorsal ray is represented as simple instead of being cleft to the base.

In all three species the head is longer than broad, the angle of the mandible is on a level with the hind margin of the eye, the humeral spine is simple, the spines borne by the palatines, just behind the anterior ends of the maxillaries, are three in number on each side (the first very small, the last the longest), and the supraorbital ridge is elevated and dentated.

There are VI, 8 dorsal and 6 anal rays, the first ray of the spinous dorsal simple and ending in a flap, the others fringed. There are two teeth on each side of the vomer.

*Chirolophius Naresii*, Günther.

The single specimen was taken at the Philippines at a depth of 115 fathoms. The humeral spine is curved upwards; the pectoral rays number 14; the posterior series of fixed teeth of the premaxillary are 13 in number. The principal measurements are:—Total length with caudal, 276 mm.; length without caudal, 220 mm.; length of head, 128 mm.; snout, 28 mm.; eye diameter, 19 mm.; interorbital width, 19 mm.; length of humeral spine, 13 mm.; length of rays of spinous dorsal, I, 67 mm., II, 60 mm., III, 90 mm., IV, 76 mm., V, 64 mm., and VI, 31 mm. Colour: brownish above, lighter below; dorsal pale, unspotted; caudal mottled with blackish.

*Chirolophius Moseleyi*, sp. n.

This species is based on a single small specimen obtained to the north of New Guinea at a depth of 152 fathoms. It differs from the preceding in having a long straight humeral spine, second ray of spinous dorsal and caudal longer, snout somewhat longer, and, considering the difference in size of the specimens, it would seem that the eyes are smaller and the interorbital space wider in this species. The principal measurements are:—Total length with caudal, 80 mm.; length without caudal, 60 mm.; length of head, 36 mm.; snout, 9 mm.; eye diameter, 6 mm.; interorbital width, 6 mm.; humeral spine, 5 mm.; length of rays of spinous dorsal, I, 18 mm., II, 31 mm., III, 25 mm., IV, 18 mm., V, 13 mm., and VI, 7 mm. Colour: brownish above, lighter below; dorsal light, with rows of dark spots; caudal pale, immaculate.

Named in memory of the late Professor Moseley.

*Chirolophius Murrayi*, sp. n.

The single example of this species was taken at Nares Harbour, Admiralty Islands. The pectorals have 18 rays, instead of 14 as in the two preceding species. The simple humeral spine is curved backwards. The snout is shorter, eyes larger, and interorbital space narrower than in *C. Naresii*, and the relative length of the rays of the spinous dorsal is also quite different. The principal measurements are:—Total length with caudal, 205 mm.; length without caudal, 160 mm.; length of head, 95 mm.; snout, 16 mm.; eye

diameter, 17 mm.; interorbital width, 13 mm.; humeral spine, 13 mm.; length of rays of spinous dorsal, I, 85 mm., II, 48 mm., III, 55 mm., IV, 36 mm., V, 24 mm., and VI, 18 mm. Colour: brownish above, lighter below; dorsal and caudal barred with rows of dark spots.

Named after Sir John Murray.

The following three species, described by Dr. Alcock in the 'Catalogue of Indian Deep-sea Fishes,' and figured in the 'Illustrations of the Zoology of the Investigator,' seem undoubtedly to belong to the genus *Chirolophius*.

*Chirolophius gracilimanus*, Alcock.

This species is described from three specimens, the largest  $4\frac{1}{4}$  inches long, from off the Malabar coast; it is evidently very close to *C. Moseleyi*, but has the humeral spine truncate and bifid, the second ray of the spinous dorsal not fringed, and the pectoral rays 18 in number.

*Chirolophius mutilus*, Alcock.

D. V, 8-9; A. 5; P. 15; second part of spinous dorsal composed of two small rays only visible after dissection; supraorbital ridge with 3 teeth, eyes large, humeral spine trifid. One specimen,  $5\frac{1}{2}$  inches long, from the Bay of Bengal.

*Chirolophius lugubris*, Alcock.

D. IV, 7-8; A. 5-6; P. 13; differs from the preceding species in having a smaller eye, and the second part of the spinous dorsal reduced to a single slender ray, not hidden. Three specimens, the largest  $5\frac{1}{2}$  inches long, from off Colombo.

The following species from the Pacific, off the coast of Central America, is described by Dr. S. Garman in the 'Albatross' report. It seems to be pretty certainly a *Chirolophius*, perhaps closely allied to *C. Murrayi*.

*Chirolophius spiturus*, Garman.

Head longer than broad, eyes large, the snout as long as the eye, humeral spine simple. D. VI, 8; A. 6; P. 17; second ray of spinous dorsal longer than the first, which is slender, without a flap. 18 vertebrae.

## LOPHIOMUS, Gill\*.

Teeth in the lower jaw mostly in 3 series, anteriorly in 4-5 series; opercular membrane without free posterior margin; gill-openings wide, below the pectorals and extending beyond them posteriorly; pectorals broad, with 22-23 rays, their bases can be received within the gill-openings. Dorsal with about VI, 8 rays, anal with about 6, the last ray of each being cleft to the base and supported by a single basal bone. Vertebrae about 19.

There is only one well-established species which certainly belongs to this genus, viz., *Lophiomus setigerus*, Wahl. After examining examples of *Lophius indicus*, Alcock, I have no hesitation in pronouncing them to belong to *L. setigerus*, as Dr. Alcock himself suggested might prove to be the case. Sir Andrew Smith's description of *Lophius upsicephalus* from the Cape of Good Hope is, so far as it goes, perfectly applicable to *L. setigerus*; and I have examined a large stuffed specimen of *L. upsicephalus* from Sir A. Smith's collection, in which the number of dorsal, anal, and pectoral rays is the same as in *L. setigerus*, with which it also agrees in the general form of the body and in the dentition; in this specimen the humeral spine is wanting. Several examples of *L. setigerus* show that during growth the posterior or lateral series of small fixed teeth in the premaxillaries increases owing to the appearance of additional teeth at its anterior end; thus a specimen 150 mm. long has 8-9 teeth in this series on each side, occupying the posterior third of the length of the premaxillaries, one 200 mm. has 12-13, and one 400 mm., 19-21, now extending over more than half the length of the bone. The example of *L. upsicephalus* is 1040 mm. long and these teeth occupy  $\frac{2}{3}$ - $\frac{3}{4}$  of the length of the bone, and are 31-34 in number. So far as is known, then, *L. upsicephalus* is not distinct from *L. setigerus*; and as this species is now known to range from the Malabar Coast to the Seas of China and Japan, its occurrence at the Cape of Good Hope cannot be regarded as surprising.

I have examined ten examples of *L. setigerus*; the head is as broad as long, and equal to about half the total length, without caudal; there are VI, 8 dorsal, 6 anal, and 22-23 pectoral rays; the humeral spine is coarse and normally ends in 5 points, but in two specimens there are 6-8 points; there are 2-3 teeth on each side of the vomer. In the young the

\* *Lophiomus caulinaris*, Garman, may belong to this genus. Head as broad as long, humeral spine trifid. D. VI, 8; A. 6; P. 17-18. 18 vertebrae.

anterior part of the tongue is white with a network of black lines, which increase in thickness during growth, the adult having pale spots on a dark ground-colour.

### LOPHIUS, Linn.

Teeth in the lower jaw in 3 series anteriorly, in 2 posteriorly; opercular membrane without free posterior margin; gill-openings wide, below the pectorals and extending beyond them posteriorly; pectorals broad, with 23-29 rays, their bases can be received within the gill-openings. Dorsal with VI, 8-12 rays, anal with 8-11, the last ray of each not cleft. Vertebrae 27-32 (? 25-35).

There are certainly four species of this genus, viz., *L. piscatorius*, Linn., *L. litulon*, Jordan, *L. Budegassa*, Spinola, and *L. Vaillanti*, sp. n., and perhaps a fifth, viz. *L. vomerinus*, Cuv. & Val. In all, as in *Lophiomus*, there are a pair of divergent spines on the palatines, and the supraorbital ridge is short and produced into two spines, thus differing from the three species of *Chirolophius* described above, which have three spines on the palatine and an elevated and dentated supraorbital ridge.

### *Lophius piscatorius*, Linn.

Length of head 2 (young) -  $2\frac{1}{2}$  times in the total length, without caudal. Skeleton fairly well ossified, tissues firm. Humeral spine stout, usually with three points (in one specimen one spine, in another both have two points only), short, its length  $5\frac{1}{2}$ -8 times in the distance from its base to the anterior end of the premaxillaries; eye diameter 7-10 times in this distance; interorbital width  $3-\frac{3}{4}$  times; length of snout  $2\frac{1}{4}$  times. Spines on the head stout, rather blunt. Teeth strong, conical, about 8-11 in the posterior series of fixed teeth on the premaxillaries, 1-3 on each side of the vomer. D. VI, 11-12; A. 10-11; P. 25-28. The rays of the spinous dorsal are rather stout, the first ends in a flap which may be simple or bifid; in one very large specimen the flap is simple, broad, and has its posterior surface entirely white; the second ray is nearly as long as the first. The distance from the tip of the last ray of the soft dorsal, when laid back, to the base of the caudal is not much more than the depth of the caudal peduncle.

Dark brownish slate-colour above, somewhat sharply separated from the white of the lower half of the body. Pectorals blackish above, below white, with a sharply defined black border. Ventrals white, blackish in young specimens.

This description is based upon twelve spirit-specimens and two skeletons in the British Museum. In two of the spirit-specimens I have examined the vertebral column, and I find the number of vertebræ in these and the two skeletons to be 31, 32, 31, and 32 respectively. In each case there are 6 vertebræ posterior to the one below the last dorsal ray. Dr. Gill gives 28 as the number of vertebræ in two specimens examined by him. Cuvier gives the number as 30, and Bonaparte as 28-31. The first vertebra is small, suturally united to the skull, and easily overlooked. Some authors have found only 10 dorsal and 9 anal rays, but it is possible that one or two of the anterior rays have been missed by them.

*Hab.* Coasts of both sides of the North Atlantic, Mediterranean.

*Lophius litulon*, Jordan.

This species is known to me only from very young examples, in one of which I find 27 vertebræ. There are VI 10 (? 9) dorsal and 9 (? 8) anal rays; the pectorals have 23-24 rays. The humeral spine is short and simple. This species is extremely similar to *L. piscatorius*, from which it appears to differ only in the simple humeral spine, the lesser number of fin-rays, and in the greater prominence of the branches of the lateral line on the upper surface of the head, a feature indicated in Dr. Jordan's figure.

*Hab.* Coasts of Middle Japan, ranging farther north than *Lophiomus setigerus* (Jordan).

*Lophius Budegassa*, Spinola.

The British Museum possesses three specimens of this species, which differs from *L. piscatorius* in the following points:—The spines on the head are somewhat longer and sharper in specimens of equal size; the humeral spine is longer, its length being contained  $3\frac{3}{4}$ - $4\frac{1}{4}$  times in the distance from its base to the anterior ends of the premaxillaries (in two specimens the humeral spines have three points, in the third that of one side is simple, of the other bifid); the teeth are slightly shorter, a single tooth on each side of the vomer; the fin-rays are fewer in number, D. VI, 8-9, A. 9, P. 24, and the rays of the spinous dorsal are more slender. The distance from the tip of the last dorsal ray, when laid back, to the base of the caudal is considerably more than the depth of the caudal peduncle. The blackish border of the under

surface of the pectorals is broader and less clearly defined than in *L. piscatorius*. In one specimen I have ascertained the number of vertebræ to be 28, 8 of which are behind the vertebra below the last dorsal ray. Cuvier gives the number as 25, and Bonaparte as 27-30.

*Hab.* Mediterranean.

*Lophius Vaillanti*, sp. n.

Five specimens, the largest 270 mm. in total length, were taken by the 'Talisman' at the Azores and Cape Verde Islands at depths of 460-760 metres; one of these is in the British Museum, the others in the Museum of Natural History at Paris. Professor Vaillant has very kindly looked at these latter, and confirms my opinion that they belong to a species distinct from *L. piscatorius*, differing notably in the feeble ossification of the skeleton, delicacy of the tissues, more elongate body, long slender teeth, bifid humeral spine, larger eye, shorter snout, and slender rays of spinous dorsal—characters which indicate that this fish probably descends to considerable depths. In the single specimen I have examined there are VI, 10 dorsal, 10 anal, and 25 pectoral rays; 14-16 teeth in the posterior series of the premaxillary, and one on each side of the vomer. Owing to the great delicacy of the tissues, there is a large hole torn in the abdomen, which has enabled me to see the anterior part of the vertebral column without further injury to the fish, from which I should judge that the vertebræ may be in somewhat greater number than in *L. piscatorius*. The measurements of this specimen are as follows:—Total length with caudal 266 mm.; length without caudal 216 mm.; length of head 96 mm.; snout 16 mm.; eye diameter 12 mm.; interorbital width 15 mm.; humeral spine 14 mm.; length of rays of spinous dorsal, I 35 mm., II 31 mm., III 24 mm., IV 23 mm., V?, VI?.

Colour pale brown; dorsal, caudal, and pectorals blackish.

*Lophius vomerinus*, Cuv. & Val.

This species is founded on a single specimen from the Cape of Good Hope, 660 mm. long. It is said to have no teeth on the vomer, on which account M. Guichenot regards it as the type of a separate genus (*Lophiopsis*). The number of rays, D. VI, 10, A. 9, P. 26, points to the probability that it belongs to this genus, but it cannot yet be certainly regarded as a distinct species.